

REMARKS

This paper is filed in response to the final Office Action mailed on September 12, 2007. Presently, Claims 1, 3-15, and 22-24 are pending in the application. Claims 1, 3-15, and 22-24 have been examined and stand rejected. Reconsideration of Claims 1, 3-15, and 22-24 is respectfully requested.

The Claimed Invention

The claimed invention is related to a method of creating a solder resist mask on a *non-photosensitive* resin layer by application of a laser directly on the layer. This method eliminates the additional steps needed for creating a mask from photosensitive resin, such as exposing and developing the photosensitive resin.

Brief Description of the References

Kamayachi et al. discloses producing a resist pattern on a *photosensitive* thermosetting resin which includes exposing the thermosetting resin to actinic radiation, developing the unexposed portions, and then postcuring the resin. (Col. 16, lines 9-31.) Therefore, Kamayachi et al. uses a *photosensitive* resin.

Paulus discloses producing a solder mask 26 by additional steps of first etching a copper foil layer above the resin layer by applying an etch resist 30, which is a photoimageable adhesive film. The etch resist 30 is photocured using a mask which allows only the region to be accessed to remain unexposed. Then, when the unexposed (uncured) etch resist is contacted with a solvent, the underlying epoxy layer 26 is exposed. (Col. 3, lines 14-28.)

The Rejection of Claims 1, 3-15, and 22-24 Under 35 U.S.C. § 103(a)

Claims 1, 3-15, and 22-24 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,943,516 (Kamayachi et al.) as supported by U.S. Patent No. 5,837,355 (Hayai) in view of U.S. Patent No. 5,626,774 (Paulus), and further in view of applicants' admitted prior art (AAPA).

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In response thereto, Claims 1, 3, 4, 6, 7, and 9 have been amended to more particularly claim the different embodiments of the invention. The claims exclude intervening steps between the step of laminating the semi-cured film and the irradiating step in Claims 1, 4, 7, 13, and 22, and exclude intervening steps between the curing step and the irradiating step in Claims 3, 6, 9, and 15.

1. The Combination of References Discloses Intervening Steps Between Applying the Thermosetting Film and Irradiating with a Laser

Admitting that Kamayachi et al. fails to teach the thermosetting film is selectively removed according to a prescribed solder-resist pattern, the Examiner relies on Paulus. Paulus teaches that a sheet of copper foil having a partially cured (B) staged thermosetting resin is applied to circuitry on the surface of the printed circuit board. The resin layer fills the spaces between the circuit features and leaves a layer of resin above the circuit features that will serve as a solder mask. However, following application of a copper foil and (B) staged resin, Paulus does not teach irradiating with a laser beam. Rather, Paulus teaches supplying an etch resist to the surface of the copper foil and photo imaging. Following this, the uncured portions of the etch resist are removed with a solvent to expose copper areas. Following this, the exposed copper is etched away, leaving the resin layer exposed. Only then is the resin removed by ablation techniques, such as plasma or laser, to expose the copper circuit feature to which a solder connection will be made.

The claimed methods exclude the steps of applying an etch resist, photo imaging, solvent removal, and copper etching as the method taught by Paulus, but, rather, directly apply a laser to the thermosetting film. Because of this, the sequence of steps as claimed is neither described nor remotely suggested by any combination of Kamayachi et al. with Paulus.

2. Kamayachi et al. Does not Disclose Laminating a Semi-Cured Film

In one embodiment, according to Kamayachi et al., a *dry film*, not a *semi-cured film*, is laminated, followed by exposure to a laser beam. (Col. 16, lines 5-6.) Alternatively in another embodiment, Kamayachi et al. teaches that if the composition is applied in the form of a liquid, a *dry film* is laminated on the applied layer of the liquid composition in a wet state or a dry state. (Col. 16, lines 6-9.)

Accordingly, Kamayachi et al. does not teach or suggest laminating a semi-cured thermosetting film, and therefore, can not disclose irradiating a laser beam onto the laminated *semi-cured* thermosetting film. Furthermore, since Kamayachi et al. does not disclose laminating a semi-cured thermosetting film, it therefore follows that Kamayachi et al. also does not teach nor suggest laminating a semi-cured thermosetting film, followed by curing the thermosetting film, then followed by irradiating a laser beam onto the laminated cured thermosetting film. Accordingly, Kamayachi et al. does not follow the sequence of steps that are recited in the claims.

When Kamayachi et al. applies a liquid composition on the board, Kamayachi et al. follows this by laminating a *dry film* on the applied layer of the liquid composition in a wet state or a dry state.

3. *Dry* Does not Mean the Same Thing as *Semi-cured* to a Person of Ordinary Skill

In rejecting the claims, the Examiner states that *dry* and *semi-cured* mean the same thing, and that such proposition is supported from U.S. Patent No. 5,837,355 (Hayai). This assertion is without any foundation nor is this interpretation supported by the evidence.

Hayai discloses a process for producing a multilayer printed circuit board, which includes the step of heating the applied undercoating agent to dry or semi-cure the undercoating agent. Therefore, *dry* and *semi-cure* are distinct alternatives, not the same thing. In fact, Hayai discloses how the heating of the undercoating agent is conducted. On Col. 5, lines 23-25, Hayai

discloses the undercoating agent is dried (a tack-free state) or semi-cured (in B stage) by heat. Furthermore, on Col. 5, line 44, Hayai discloses that the undercoating agent coated on the interlayer circuit board is dry-solidified or semi-cured (to B stage) by the evaporating of a solvent, or semi-cured in case of a solvent-free type. *"B stage," which signifies a semi-cured state, indicates an advanced state of curing but a still thermoplastic state, that is, a state which is not advanced to a gel state.* (Emphasis added.)

From the above disclosure, it is abundantly clear that Hayai treats dry and semi-cured as two distinct alternatives, which do not support the interpretation advanced by the Examiner.

Accordingly, Kamayachi et al. does not disclose laminating a semi-cured film.

For all the above reasons, the withdrawal of the rejection is respectfully requested.

CONCLUSION

In view of the foregoing amendments and remarks, applicants submit that the application is in condition for allowance. If the Examiner has any further questions or comments, the Examiner may contact the applicants' attorney at the number provided below.

Respectfully submitted,

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